CLAIMS

1. A method of manufacturing a substrate with a plurality of concave portions, the method comprising the steps of:

forming a mask on the substrate;

forming a plurality of initial holes on the mask by means of a physical method; and

forming the plurality of concave portions in the substrate by subjecting the mask with the plurality of initial holes to an etching process.

2. The method as claimed in claim 1, wherein the physical method includes blast processing.

3. The method as claimed in claim 2, wherein the blast processing is carried out using glass beads as blast media.

4. The method as claimed in claim 2, wherein the blast processing is carried out using blast media of which average diameter is in the range of 20 to 200μm.

5. The method as claimed in claim 2, wherein the blast processing is carried out by spraying blast media with the blast pressure in the range of 1 to 10kg/cm^2.

6. The method as claimed in claim 2, wherein the blast processing is carried out by spraying blast media so as to have a blast density in the range of 10 to 100kg/m^2.

7. The method as claimed in claim 1, wherein the mask is formed of Cr or chromium oxide as a main component thereof.

8. The method as claimed in claim 1, wherein the average thickness of the mask is in the range of 0.05 to 2.0μm.

9. The method as claimed in claim 1, wherein the etching

process includes a wet etching process.

10. The method as claimed in claim 9, wherein the wet etching process is carried out using ammonium hydrogen difluoride or ammonium fluoride as an etchant.

11. The method as claimed in claim 1, further comprising the step of removing the mask after the etching process.

12. The method as claimed in claim 1, wherein the substrate is constituted from alkali-free glass.

13. The method as claimed in claim 1, wherein the plurality of concave portions are provided for microlenses.

14. A method of manufacturing a substrate with a plurality of concave portions, the method comprising the steps of:

forming a mask on the substrate;

forming a plurality of initial holes on the mask by means of irradiation with laser beams; and

forming the plurality of concave portions on the substrate by subjecting the mask with the plurality of initial holes to an etching process.

15. The method as claimed in claim 14, wherein the mask is formed of Cr or chromium oxide as a main component thereof.

16. The method as claimed in claim 14, wherein the average thickness of the mask is in the range of 0.05 to 2.0μm.

17. The method as claimed in claim 14, wherein the etching process includes a wet etching process.

18. The method as claimed in claim 17, wherein the wet etching process is carried out using ammonium hydrogen difluoride or ammonium fluoride as an etchant.

19. The method as claimed in claim 14, further comprising the step of removing the mask after the etching process.

20. The method as claimed in claim 14, wherein the substrate is constituted from alkali-free glass.

21. The method as claimed in claim 14, wherein the concave portions are provided for microlenses.

22. A substrate with a plurality of concave portions, the substrate being manufactured by a manufacturing method, the method comprising the steps of:

forming a mask on the substrate;

forming a plurality of initial holes on the mask by means of a physical method or irradiation with laser beams; and

forming the plurality of concave portions in the substrate by subjecting the mask with the plurality of initial holes to an etching process.

23. A substrate with a plurality of concave portions for microlenses, the substrate being manufactured by a manufacturing method, the method comprising the steps of:

forming a mask on the substrate;

forming a plurality of initial holes on the mask by means of a physical method or irradiation with laser beams; and

forming the plurality of concave portions on the substrate by subjecting the mask with the plurality of initial holes to an etching process, the plurality of concave portions being provided for microlenses.

24. A microlens substrate with a plurality of microlenses, the microlens substrate being manufactured using a substrate with a plurality of concave portions for microlenses, the substrate being manufactured by a manufacturing method, the method comprising the steps of:

forming a mask on the substrate;

forming a plurality of initial holes on the mask by means of a physical method or irradiation with laser beams; and

forming the plurality of concave portions in the substrate by subjecting the mask with the plurality of initial holes to an etching process.

25. A transmission screen comprising a microlens substrate with a plurality of microlenses, the microlens substrate being manufactured using a substrate with a plurality of concave portions for microlenses, the substrate being manufactured by a manufacturing method, the method comprising the steps of:

forming a mask on the substrate;

forming a plurality of initial holes on the mask by means of a physical method or irradiation with laser beams; and

forming the plurality of concave portions in the substrate by subjecting the mask with the plurality of initial holes to an etching process.

26. The transmission screen as claimed in claim 25, further comprising a Fresnel lens portion with a Fresnel lens, the Fresnel lens portion having an emission face and the Fresnel lens being formed in the emission face wherein the microlens substrate is arranged on the emission face side of the Fresnel lens portion.

27. The transmission screen as claimed in claim 25, wherein the diameter of the microlens is in the range of 10 to 500μm.

28. The transmission screen as claimed in claim 26, further comprising a light diffusion portion arranged between the Fresnel lens portion and the microlens substrate.

29. The transmission screen as claimed in claim 28, wherein the light diffusion portion is adapted to diffuse light so that the light is diffused on a substantially entire surface of the light diffusion portion.

30. The transmission screen as claimed in claim 28, wherein the haze value of the light diffusion portion is in the range of 5 to 95%.

31. The transmission screen as claimed in claim 28, wherein the glossiness of the light diffusion portion is in the range of 5 to 40%.

32. The transmission screen as claimed in claim 28, wherein the surface of the light diffusion portion has an irregularities comprised of roughly subulate concave portions.

33. The transmission screen as claimed in claim 28, wherein the light diffusion portion includes a resin sheet having one roughened surface.

34. The transmission screen as claimed in claim 28, wherein the diameter of the microlens is in the range of 10 to 500μm.

35. A rear projector comprising a transmission screen, the transmission screen having a microlens substrate with a plurality of microlenses, the microlens substrate being manufactured using a substrate with a plurality of concave portions for microlenses, the substrate being manufactured by a manufacturing method;

wherein the method comprises the steps of:

forming a mask on the substrate;

forming a plurality of initial holes on the mask by means of a physical method or irradiation with laser beams; and

forming the plurality of concave portions in the substrate by subjecting the mask with the plurality of initial holes to an etching process.

36. The rear projector as claimed in claim 35, further comprising:

a projection optical unit; and
a light guiding mirror.